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Texas Agricultural Extension Service

CITRUS

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HOME FRUIT PRODUCTION—CITRUS

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Commercial citrus production in Texas is mostly limited to the Lower Rio Grande Valley. Small plantings that formerly existed near Beaumont, Orange, Houston, Beeville, Falfurrias and Carrizo Springs have mostly disappeared because of economics and recurring freezes. Nonetheless, many Texas residents want citrus trees in the home landscape to enjoy their dark, evergreen foliage, fragrant blossoms and colorful, delicious fruit.

CLIMATE

Citrus trees growing outside the Valley are at a distinct disadvantage with regard to climate, i.e., winter almost always will be accompanied by one or more freezes. Citrus trees are subtropical to tropical in nature; thus, they may suffer severe damage or even death because of freezing temperatures. However, several types of citrus have sufficient cold-hardiness to sustain some freezing conditions, particularly as mature trees. The resident of coastal and southern Texas who is willing to put forth the effort to provide cold protection for young trees—and sometimes even mature trees—can successfully produce home citrus fruits.

SOIL REQUIREMENTS

All citrus trees require deep soil having both good surface and internal drainage. Surface drainage refers to runoff to prevent water standing around the tree. Internal drainage is the ability for water to percolate downward through the soil to preclude saturation of the root zone.

The presence of vigorous, healthy landscape trees is a good indication that the soil is sufficiently deep and well-drained for citrus trees. Should uncertainty about internal drainage exist, dig a posthole 3 to 4 feet deep and fill it with water. All water should drain from the hole within 24 to 36 hours; soils requiring more than 48 hours to drain completely should be avoided unless raised planting beds are used.

Most citrus grows well in a soil pH range from 6 to 8. Avoid soils that have a high caliche content or are excessively salty, as citrus trees will not grow well in such soils.

SITE SELECTION

Most residential lots do not offer much choice in terms of planting sites for citrus trees. Nonetheless, several factors do require consideration.

Avoid planting near septic tank lines to preclude future problems with tree roots clogging the lines. In cold-sensitive areas, plant citrus trees on the south and southeast sides of the house to provide some protection from northwesterly cold fronts. The house will lose considerable heat, providing some additional protection to trees planted nearby.

Planting under large, overhanging trees offers some cold protection, but growth and production of citrus under other trees is not entirely satisfactory. Citrus requires full sunlight for optimum growth and production.

Plant most citrus trees 6 to 8 feet from buildings, driveways, walkways and fences, and twice that far from each other, to preclude later problems with pruning and tree size control. The natural form of citrus is for the ends of the lower branches to almost touch the ground when fruit is present, so allow for this natural growth at planting.

VARIETIES

Characteristics of the most common citrus varieties are shown in Table 1. Not all of these are readily available in nurseries, but they are varieties which have been grown in Texas prior to the 1983 freeze. Consequently, a renewed demand for some of these citrus varieties should stimulate nursery interest in propagating them.

Seedling citrus trees are those grown from seed. Some productive seedlings do exist in Texas, but very few have the quality of named varieties. Although the seed of some types of citrus come true-to-type, seedlings which do not usually are thorny, slow to come into production and then frequently produce seedy fruit. Seedling trees are more cold-hardy than budded trees—an advantage they lose upon being budded—but most seedlings are more susceptible to foot rot.

Many current citrus varieties originated as chance seedlings or bud sports of other citrus. To achieve varietal significance, the attributes of such a tree must equal or exceed those of existing varieties.

CITRUS ROOTSTOCKS

Most citrus types and varieties do not perform well on their own root system so they are commonly budded onto rootstocks which are better adapted to certain soil conditions. Most citrus trees are comprised of a desirable scion variety T-budded onto a seedling rootstock several inches above the soil line. The rootstock of a budded tree includes all roots and

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Table 1. Characteristics of common Texas citrus varieties.

Variety	Tree size	Fruit size	Seediness[1]	Rind color	Season	Cold hardiness	Comments
Oranges[2]							
Navel	large	large	0-6	light yellow-orange	Oct-Dec	good	low production
Marrs	large	medium	0-6	yellow-orange	Oct-Jan	fair	
Pineapple	large	medium	seedy	yellow-orange	Nov-Feb	fair	
Hamlin	large	medium	0-6	yellow-orange	Oct-Jan	fair	
Valencia	large	medium	0-6	orange-yellow	Mar-Jun	fair	
Grapefruit[3]							
Marsh	v. large	v. large	0-6	light yellow	Oct-May	fair	white flesh
Ruby Red	v. large	v. large	0-6	yellow, red blush	Oct-May	fair	typical red flesh
Henderson/Ray	v. large	v. large	0-6	light yellow, red blush	Oct-May	fair	redder than Ruby Red
Rio Red	v. large	v. large	0-6	light yellow, red blush	Oct-May	fair	dark red flesh
Star Ruby	v. large	v. large	0-9	yellow, red tinge	Oct-May	fair	deep red flesh
Mandarins and tangelos[4]							
Satsuma, Owari	medium	small	0-4	orange-red	Oct-Dec	v. good	Armstrong and Kimbrough varieties
Clementine tangerine	medium	small	seedy	dark orange-red	Oct-Dec	v. good	needs pollinizer[5]
Dancy tangerine	medium	small	seedy	dark orange-red	Nov-Jan	v. good	
Changsha tangerine	medium	small	seedy	orange	Oct-Jan	v. good	comes true from seed
Orlando tangelo	medium	medium	seedy	light orange	Nov-Jan	good	needs pollinizer[5]
Minneola tangelo	medium	large	few	red-orange	Dec-Jan	good	needs pollinizer[5]
Acid citrus							
Calamondin	small	v. small	3-7	orange-yellow	Jan-Dec	good	so-called miniature orange
Mexican lime	medium	small	3-9	greenish-yellow	Jan-Dec	poor	thorny and thornless types
Tahiti lime	medium	medium	0-6	greenish-yellow	Jan-Dec	poor	Persian lime
Nagami kumquat	small	v. small	2-5	orange	Oct-Mar	v. good	oval, tart
Meiwa kumquat	small	v. small	1-3	orange	Oct-Mar	v. good	round, sweet
Meyer lemon	small	medium	few	lemon yellow	Aug-Mar	fair	not a true lemon
Ponderosa lemon	medium	v. large	seedy	lemon yellow	Jan-Dec	poor	
Lemon, Eureka	medium	medium	0-6	lemon yellow	Jul-Mar	poor	Lisbon and Villafranca varieties
Limequat	small	v. small	few	yellow	Jan-Dec	good	Eustis variety

[1] Varieties having 0-9 seeds per fruit are considered seedless.
[2] Other oranges include Jaffa and blood oranges (which may or may not produce blood-color in the flesh). Numerous navel orange varieties include Washington, N33E, Texas, Everhard, Thompson and others.
[3] Another grapefruit is Duncan, which is seedy and white fleshed.
[4] Other mandarins include Robinson tangerine, Fortune tangerine, Ponkan (Chinese Honey Orange or Warnurco), Bower, Fairchild and Murcott Honey Orange.
[5] Clementine, Orlando, Marrs and Robinson are good pollinizers.

the lower few inches of the trunk, whereas the scion is the trunk and all branches, leaves and fruit.

Sour orange, the most common rootstock in Texas, is well-adapted to most soil conditions in which citrus is grown. Trifoliate orange is more cold-hardy than sour orange and produces a smaller tree, but it is not well adapted to saline or highly alkaline soils. Consequently, trifoliate orange is preferred for the upper Gulf Coast and colder areas where soil conditions are suitable, but sour orange is recommended for the lower coast and most of southern Texas.

SELECTION AND PLANTING

Most citrus nursery stock available at retail is containerized, either having been grown entirely in containers or field-grown and transplanted into containers prior to sale. Normally, the bud union will be readily discernible as a cut area at a dogleg bend in the trunk. The cut area is where the top of the rootstock was cut off to allow the budded top to grow erect. This area should be healing over with bark at the time of purchase. The crook in the trunk will disappear within a couple of years, but the bud union will remain discernible for years as a distinct line of contrast between bark textures of the stock and scion.

Container trees are available year-round and can be planted anytime. Best results come from planting during fall to late winter as the tree can become better established before the onset of hot, dry weather of late spring and summer.

Most container citrus trees are grown in a soilless medium that usually contains a fair proportion of peat moss. The roots of such trees tend to remain within the growing medium long after planting, thereby resulting in poor establishment and growth. To avoid this problem, wash off an inch or more of the growing medium all around the root ball—including the top—immediately before setting the tree in the ground. Thus, the peripheral roots will be placed into intimate contact with the soil in which they must survive and grow, resulting in better tree establishment.

Planting depth is critical to the survival of citrus trees. The rootstock is somewhat resistant to foot rot disease, but the top is quite susceptible. If the bud union is too low with respect to surrounding ground, the tree could contract foot rot and die. The practice of scooping out grass and soil to form a large depression for ease of watering almost guarantees the death of a citrus tree.

Remove lawn grass in a circle 3 to 5 feet in diameter, centered on the planting hole. Dig the planting hole half again wider than the root ball. In a bare ground situation, dig the hole exactly the same depth as the root ball, but in lawn grass, dig it 1 inch less than the root ball depth. The best way to

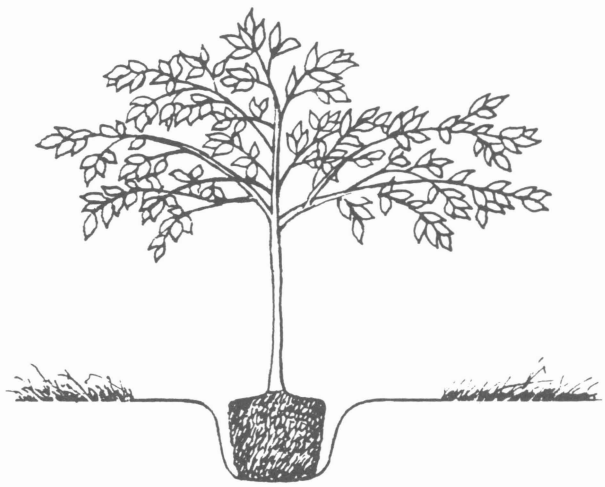

Figure 1. Dig the planting hole 1 inch less than the root ball depth.

determine proper depth is to lay a shovel handle or similar object across the hole, with both ends laying on undisturbed ground or the lawn grass.

Mixing topsoil, compost, peat or other materials with the backfill soil is unnecessary in good citrus soils. Set the tree in the hole, backfill about halfway, then water sufficiently to wet the backfill and settle it around the roots. Complete filling the hole and tamp the soil lightly into place. Cover the root ball with 1/2 to 1 inch of soil to seal the growing medium from direct contact with the air and prevent rapid drying of the root ball.

Build a watering ring atop the ground around the tree, about 5 to 6 inches high and 6 to 8 inches thick. The ring should be slightly wider than the planting hole—if adequate soil isn't left over from planting, borrow some from the garden. Fill the water basin with water. When the water soaks in, it may be necessary to add a little soil to the holes made as the soil settled around the root system.

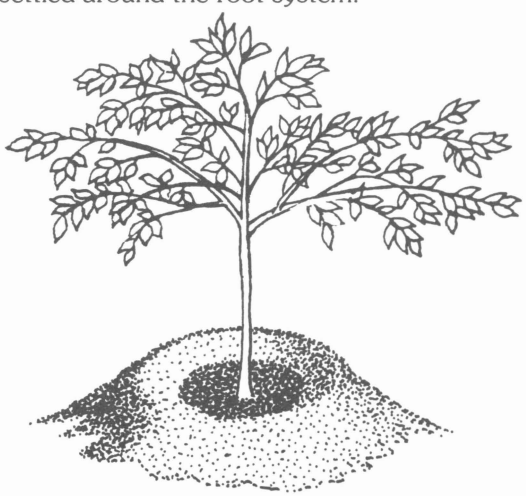

Figure 2. Build a watering ring slightly wider than the planting hole.

YOUNG TREE CARE

Water

Newly-planted citrus trees require thorough watering two to three times the first week and one to two times per week for the next few weeks, depending upon soil type, rainfall and time of year. Then, apply water when the soil begins to get dry an inch or so down. Simply fill the water ring each time. The watering ring should erode away over time (4 to 6 months), at which time the tree can be considered established and watered as needed by soaker hose or sprinkler system.

Nutrition

Do not apply fertilizer until the tree begins new growth after planting. Fertilize monthly through October. Scatter fertilizer on the ground at least a foot from the tree trunk and promptly water it in thoroughly.

Nitrogen is usually the only fertilizer element required in most Texas soils, but additional elements should not do any harm. Consult your local county Extension agent. Available fertilizers may vary in terms of the percentage of nitrogen, but the following is a general rule regarding the quantity to apply:

Amount of fertilizer/tree, applied monthly, February—October

	Nitrogen content	
	8-13 percent	**17-21 percent**
First year	1 cup	1/2 cup
Second year	2 cups	1 cup
Third year	4 cups	2 cups

Weed Control

Good weed control is essential for rapid establishment and vigorous growth of young citrus trees. Eliminate all existing lawn grass and weeds for several feet around the tree. As the spread of the tree increases, widen the grass-free area beyond the tree canopy or drip-line.

Weed control can be accomplished by mechanical means such as hoeing. Organic mulches are not recommended for citrus trees because of the potential for inducing foot rot disease. If mulches are used, keep at least 12 inches of bare ground between the tree trunk and the mulch. Herbicides such as Roundup® (Kleenup®) are excellent for control of existing weeds and pre-emergent herbicides may be used to prevent weed seeds from germinating.

Pruning/Training

Citrus trees are sold already properly shaped and pruned to develop naturally, so pruning and training of a citrus tree is not necessary. The only exception is that shoots from below the head (scaffold limbs), whether on the rootstock or the scion, should be removed as soon as they are noted.

Cold Protection

Several kinds of wraps are used on the trunk of young citrus in the belief that they will provide significant cold protection. With one exception, none provide more than a few degrees of protection to a young tree trunk. The wraps do prevent rodent damage and sprouts on the trunk, but they also may harbor insects, particularly ants, which can cause problems. The best cold protection possible for young citrus is a soil bank, which can be used for the first two to four winters.

Soil banks are put up around Thanksgiving and taken down about the first of March. A soil bank is a mound of soil piled as high as feasible around the trunk and lower scaffold limbs. Thus, the trunk and lower scaffolds will be protected from even the worst freeze, although the unprotected top may be killed completely. The tree will regrow from the trunk and scaffolds without going back to the rootstock.

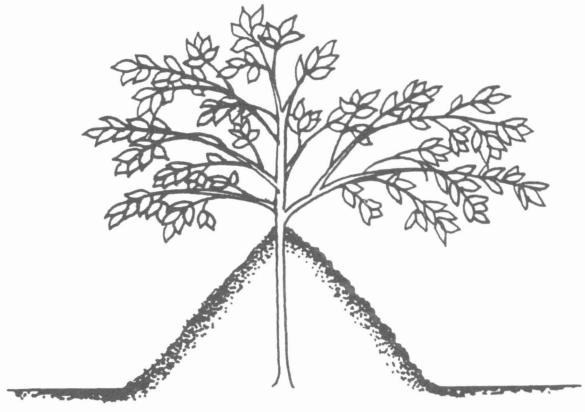

Figure 3. A soil bank around a young citrus tree for cold protection.

Before banking, treat the bark to be covered with a suitable insecticide and a copper-based fungicide to preclude problems while the bank is up. Exercise extreme care in removing the banks to prevent damaging the bark, as it will be quite tender from spending the winter underground. Use the garden hose to wash off the last of the soil.

If there is not enough soil from around the tree to build a good bank, borrow from the garden or use potting soil. The extra soil should be taken away upon bank removal.

Other cold protection means are discussed under mature tree care.

CARE OF ESTABLISHED CITRUS TREES

Cultural practices for established citrus trees are designed to maintain good growth and vigor to maximize the production of quality fruit. The common components of all cultural programs are irrigation, fertilization and weed and grass control. Pruning is rarely necessary. Pest control may be necessary to produce bright, clean fruit, and occasionally to maintain tree health and vigor.

Water

Irrigation in the home landscape, probably the most expensive and time-consuming production practice, is poorly understood. Water commonly is applied too frequently and in inadequate amounts, resulting in inefficiency, waste and less than optimum growth and production.

Most soils in southern Texas hold between 3 and 7 inches of water in the upper 3 feet of depth, with sandy soils at the low level and heavier clay soils at the upper level. This is the reservoir of soil moisture available to plants.

The soil moisture reservoir is depleted by plant use and evaporation from the soil surface—both dependent on season and prevailing weather. Most plants do not use much water in the cooler months because weather conditions are not too favorable for their growth and do not favor evaporation. Irrigation with too little water does not completely replenish the soil reservoir, but excess water percolates down through the soil and is lost. Because it is not practical to replace soil moisture at the same time and rate as it is being used, watering is scheduled periodically to refill the soil reservoir.

A good irrigation schedule for established trees is simple to develop. You need a couple of pet food or tuna fish cans about 2 inches tall. Set them up somewhere in the middle of the yard so they will be exposed to wind, rain, sun, etc. and cover with wire mesh to prevent birds from drinking from them. Fill with water immediately after a thorough irrigation or good soaking rain.

Assume the can will hold 2 inches of water. From mid-April through mid-September, irrigate with 1 1/2 inches of water when the can is completely dry, then refill the can and wait for the water to evaporate again. The rest of the year, irrigate with 1 inch of water when the can is dry. The difference is that growth in the cooler months uses only about half as much water as evaporates, while growth in the warmer months uses about three-fourths as much water as evaporates.

Sandy soils usually can absorb water as fast as you can apply it, but water penetrates very slowly in clay soils. Adjust the application rate to prevent water runoff.

Nutrition

The soil must provide 13 nutrient elements essential to all plant growth. Southern Texas soils generally are quite fertile and contain more than adequate quantities of all essential elements except nitrogen. The other elements rarely need to be applied to mature, established citrus. However, the exceptions are important.

Clay soils usually contain plenty of iron, but citrus trees may exhibit iron deficiency in the early spring. Usually, the deficiency clears up as the soil warms up. If it does not, soil application of iron chelates is necessary. Where iron deficiency does occur, do not use fertilizers which contain phosphorous because high phosphorous aggravates iron and zinc deficiency in high pH (alkaline) soils. Red, sandy soils may need supplemental potassium and sandy soils in general may need additional zinc.

Mature, bearing citrus trees should receive enough nitrogen to provide for good but not excessive growth. If the percentage of nitrogen in the fertilizer is less than 15 percent, apply about 1 pound per inch of trunk diameter per year. If the percentage is above 20, use 0.75 pound or less per inch of trunk diameter per year. One pound of dry fertilizer is approximately 2 cups.

The fertilizer may be applied at one time for the year, usually in February, or it may be split into two or three applications. Two applications are recommended, with two-thirds of the fertilizer applied in February and the balance in May. However, equal applications in February, May and September are effective, also.

The most expedient application is to spread the fertilizer uniformly on the soil surface under the tree canopy and slightly beyond and water it in thoroughly. It is not necessary to drill holes in the soil for fertilizer as a thorough watering will carry surface-applied fertilizer throughout the soil profile.

Weed and Grass Control

Control weeds and grass beneath citrus trees to reduce competition for fertilizer and water. Also, weeds and grass may harbor pests which can affect the fruit or trees. It is easier to control weeds or grass than to mow under citrus trees and perhaps cause bark or fruit damage from lawnmowers.

Mulches are commonly used to conserve moisture and control weeds and grass. Because of the incidence of foot rot disease in citrus, organic mulches are not recommended. If used, keep mulches at least a foot away from the tree trunk.

Pruning

Citrus trees are pruned primarily to control tree size and to remove dead, diseased or damaged

wood. Citrus trees should be allowed to grow naturally without pruning.

See the section on freeze rehabilition for proper pruning of freeze-damaged citrus trees.

Pest Control

Citrus pests in Texas include insects, mites and diseases which may affect the health and vigor of the trees or the appearance of the fruit. Few pests actually kill citrus trees, but those that do are noteworthy because prevention is the only control.

Tristeza is a virus disease that kills citrus trees quickly, particularly those growing on sour orange rootstock. Tristeza is present in Louisiana, Florida and other areas, but not in Texas. For that reason, it is illegal to import citrus trees, budwood or other tree parts from other states or countries.

Foot rot is a fungal disease present in many Texas soils. Both sour orange and trifoliate orange rootstocks have some resistance to the disease, so it is not a problem unless the tree is planted too low and the bud union is exposed to soil or standing water.

Monitor and control outbreaks of pests or diseases which affect tree vigor, as reduced vigor results in reduced production. Aphids, mites, scales and whiteflies are good examples. Mites, particularly the citrus rust mite, can badly blemish the rind. However, rind appearance does not adversely affect eating quality of the fruit.

Where pest control is necessary or desirable, contact your county Extension agent for confirmation and recommendations. In using any pesticide, read fully and follow completely all label directions.

COLD PROTECTION

Citrus trees anywhere in Texas ultimately will be threatened by a severe freeze. Consequently, cold protection practices must be implemented to minimize the damage. The duration of freezing temperatures can be more critical than the minimum temperature, i.e., a brief drop to 24°F may not cause as much damage as several hours at 26°F. Moreover, exposure to cold weather increases the ability of citrus trees to withstand cold, as short days and cool weather condition the tree to stop growing and acquire greater cold-hardiness. For example, satsuma may withstand 18°F in early February when it is completely dormant and most cold-hardy, but may be seriously damaged at 24°F in early December.

Citrus trees in colder areas of southern Texas usually will attain greater cold-hardiness than those in the Valley. However, residents of freeze-prone areas should grow only cold-hardy types of citrus such as kumquats, satsuma mandarin, tangerines, calamondin and some tangelos.

The soil under and around the citrus tree should be bare and firm insofar as possible in a landscape setting. Remove mulches before winter. Thoroughly irrigate the citrus tree and surrounding areas several days before a hard freeze is anticipated. Bare ground can absorb more heat from the sun than can soil covered by weeds, grass or mulch. Moist soil can absorb more heat and conduct heat better than dry soil. Consequently, pre-freeze irrigated bare ground can absorb, store, conduct and release more heat to the tree during a freeze.

The tops of citrus trees may be draped with blankets, quilts or plastic for further protection. It is not necessary to encase the tree completely. Put such coverings on and anchor them securely the afternoon before the freeze. Remove plastic coverings during sunny days to prevent cooking the trees. Permeable covers can be left in place until freeze danger has ended.

Additional heat can be provided and is very effective in combination with covers, particularly if the cover does not completely encase the tree. Incandescent lights (such as trouble-shooter lights) in the tree or small electric heaters under the tree generate considerable heat. Exercise extreme caution with electrical equipment outdoors, as many freezes begin with strong winds and often include precipitation.

A gas lantern or camp stove will burn for 10 to 12 hours on a tank of fuel, but will require pumping up once during the night. The propane types do not require pumping. These can be placed on the ground beneath the tree. A portable gas grill works fine on low heat—if there is room to place it under the tree—but leave the lid closed.

A water sprinkler placed over the tree (without the other methods) can prevent freezing by covering the tree with ice. But, the sprinkler must be started before the temperature drops to the critical level—28° F on calm nights, 30° F on windy nights—and must run continuously until the temperature is sufficiently above freezing that ice *in the shade* begins to melt. However, the ice load can cause significant limb breakage and a freeze lasting several days can result in excessive waterlogging of the soil.

FREEZE REHABILITATION

Despite your best efforts, freeze-damage does occur to citrus trees. The immediate urge is to begin cutting off the deadwood—but there is no effective way to determine the extent of deadwood immediately. While it may be unsightly in the residential landscape, delay pruning until May.

Citrus trees lose their leaves (and fruit) after a severe freeze, but they send out new growth in

March. Much of this lush spring growth dies back in April because of underlying damage to the wood and bark. Consequently, delay pruning until after the dieback has occurred.

Dead bark seems to shrink tightly around the limb, while live bark keeps growing outward, creating a distinct ridge between the two. The ridge will be irregular around the limb. Scrape lightly across the ridge with a knife blade to delineate the green, live bark. Cut off the limb below the lowest limit of the dead bark so that live bark completely encircles the limb stub. Treatment of cut-off limb stubs with wound dressing or pruning paint is not necessary for proper healing.

A soil-banked young tree may be killed to the bank. After removing the bank, a new top will grow from the undamaged trunk. Such new trees are commonly multi-trunked because several shoots arise.

In the worst case, an unbanked citrus tree may be killed to the ground. However, the rootstock will usually send up new shoots which will ultimately bear fruit. Unfortunately, these are rootstock fruits, not what you had before the freeze. It is possible to propagate desirable budwood onto these root sprouts, but it is simpler to plant a new tree of the desired variety and start over properly.

PRODUCTIVITY AND MATURITY

Most budded citrus trees can produce a few fruit in the second year from planting, but usually do not produce until the third year. Thereafter, production increases annually as tree size increases. Seedling trees may not bear for several years.

There usually are four or five flushes of new growth on a citrus tree each year. Each flush is capable of producing flowers and setting fruit, but most citrus in Texas rarely produces any flowers or fruit after the spring growth flush. The exceptions are lemons and limes which can flower and set almost year-round, as do kumquats and calamondin. Off-bloom (i.e., non-spring flush) fruit of oranges, tangelos, grapefruit and others are puffy, having a very thick peel, and sheepnosed in shape. Rarely is juice quality comparable to normal.

Typical citrus trees go through three distinct periods of fruit drop. First is the drop of about 70 to 80 percent of the flowers during and immediately following bloom. The second drop occurs a couple of weeks later, involving small fruit of pea-size to marble-size. The third drop occurs in late May, involving larger fruit almost golf ball size. Navels will drop again in mid-summer and in late summer. A few fruit on all citrus will continue to drop through final harvest, but that is normal and cannot be prevented.

Excluding the semi-everbearing citrus, most other types mature in the fall, including mandarins, tangelos, grapefruit and most oranges. The juice quality of all citrus fruits improves during the season, i.e., the longer it stays on the tree, the better it gets. Citrus fruits generally store well on the tree—some fruit drop does occur but is usually compensated by increased size of the remaining fruit. Even so, citrus fruits will ultimately begin to dry out on the tree, so they should be harvested and used during their season (as indicated in Table 1).

GROWING CITRUS IN CONTAINERS

Citrus trees generally do not perform well as houseplants, but several kinds can be adapted to container culture. However, none will be as attractive or grow and fruit as well as trees grown under optimal conditions in the soil.

The smaller citrus types (calamondin, limes, kumquats, lemons and limequats) are best suited to container culture, but all will grow for a limited time.

Containers may be of any suitable material, but must have adequate holes at the bottom to drain excess water. Size of the container will be the most limiting factor, as it should be large enough to permit maximum growth, yet small enough to be readily moved indoors during freezing weather.

Potting

Cover the drainage holes with screen mesh to prevent soil from washing out. Potting soil is suitable, but an adequate mix can be made of one part sand, one part peat moss and one part composted bark. Partially fill the container and set the plant to its correct depth, which is the level at which it was grown previously. The final soil surface should be 1 to 4 inches below the container rim to allow for easy watering. Complete filling the container, firm the soil or media around the plant and water thoroughly. An attractive mulch of bark, gravel or other material can be added to improve the appearance of the container.

Light

Citrus grows best in full sunlight, but place container-grown citrus to receive partial shade to reduce growth and to provide better acclimation to the occasional trips indoors during winter. Avoid extremely low light for prolonged periods as the trees will become leggy and unattractive.

Avoid extremely rapid changes in light exposure to prevent excessive leaf drop. Acclimate plants that will be moved indoors for the entire winter by gradually reducing the existing light, possibly by partial shading, for 2 to 4 weeks before moving them inside. Reverse the process for moving outdoors. Such acclimation is not necessary for trees that are to be indoors for only a few days during freezes.

Freezes

The root system is more susceptible to cold damage because it is not so well insulated in containers as in the ground. Container-grown citrus will require some

form of cold protection to survive most freezing temperatures. Moving them indoors during freezes may be the simplest solution.

Water

Overwatering is the most common cause of poor performance of container citrus trees. Water only as needed. Generally, allow the upper inch of the medium to become dry before watering. Then apply water slowly to fill the container, permitting the excess to drain out the bottom.

The soils in plastic, metal and ceramic containers generally stays wet longer than it does in wood or clay containers which permit water evaporation through the sides. Cool weather slows growth, so reduce watering frequency during winter.

Nutrition

Good nutrition is essential, but overfertilization and low light can result in leggy growth. Numerous water-soluble fertilizers are available and should be used according to label directions. Generally, a deep green color of mature foliage indicates adequate nutrition.

Salt accumulation from salts in the water and fertilizer salts can cause a white crust on the soil or container, as well as leaf burn and twig dieback. Periodically leach salts by slowly running water into the container for several minutes to carry soluble salts through the soil and out the drainage holes.

Pruning

Trees will become leggy when grown indoors in poor light for too long. To overcome this, cut back the entire top by about a third to induce more branching and bushiness (Note: more adequate light is still necessary). Such heavy pruning is best done during February so that flowering and fruiting are least affected.

Twig dieback and leaf drop may occur if the top gets too large for the capability of the root system. Such plants require moderate pruning to balance the top with the roots and rejuvenate the plant.

Fruitfulness

Citrus will produce fruit when grown in containers, given time, good care, adequate size and age. Do not expect large yields as the amount of fruit produced is proportional to tree size, which will be limited by the size of the container in which it is grown.

DIAGNOSING CITRUS PROBLEMS

Citrus normally grows and produces well without undue attention or difficulty but occasional problems do occur. Unfortunately, few problems are noted in time to apply preventive or corrective measures for that particular situation. Most problems are not serious and can be ignored completely or alleviated by minor adjustments in cultural practices. Few citrus problems warrant the use of pesticides. Contact your county Extension agent for confirmation and recommendations.

Table 2 lists many common citrus problems by category of the affected part of the tree, i.e., fruit, leaves and twigs and branches, trunk or entire tree.

Table 2. Diagnosis of common citrus problems.

Symptom	First noticeable	Primary cause	Occurs	Control and/or comments
Fruit				
1. Premature rind coloring	late summer	plant bugs	mid-summer	Rarely serious enough to control
2. Creases in rind	harvest	physiological	spring	Follow irrigation and fertilization recommendations
3. Necrotic spots on rind, lower part	2 or 3 weeks after spraying	spray burn	after spraying	Excess spray accumulates near bottom of fruit
4. Thick rind, puffy fruit, sheepnose	harvest	excess vigor	since bloom	Follow good cultural practices, typical of off-bloom fruit
5. Rust colored or brown rind	anytime	citrus rust mite	since bloom	Does not affect eating quality, use miticide only if necessary
6. Silvery to tan irregular, smooth blemishes	harvest	wind scar	March-April	Not necessary, quality unaffected
7. Small, brown spots on rind, rough texture, may tearstreak	harvest	melanose fungus	March-April	Affects grapefruit only, remove dead twigs inside canopy
8. Removable, small, colored, raised spots on rind	summer to harvest	scale insects	summer	Spray only if problem is extensive on the bark

Symptom	First noticeable	Primary cause	Occurs	Control and/or comments
9. Cottony masses near fruit stem	summer to harvest	mealybug or cottony cushion scale	summer	Rarely serious, hard to control
10. Black, sooty covering	harvest	sooty mold	since bloom	Whiteflies, blackflies, mealybugs and other insects, usually gone before problem is noticed
11. Fruit drop	since bloom	physiological	since bloom	Read "Productivity and Maturity" section
12. Fruit splitting on-tree	September	physiological	summer	Dry weather followed by good rain, proper irrigation lessens the problem
Leaves and twigs				
1. Leaf cupping and curling	after new flush	aphids	during each flush	Not serious, check new growth as it emerges
2. Silvery, scratchy appearance to leaf	summer, fall	spider mites	spring to fall	Could cause excessive fall leaf drop, spray if necessary
3. Small, brown spots, sand-papery texture	spring, summer	melanose fungus	after growth flush	Affects grapefruit, usually after spring rains; remove dead twigs
4. Irregular, oily spots on foliage	summer to winter	greasy spot fungus	summer	Remove fallen leaves, particularly in summer
5. Raised, irregular tar-like spots underleaf	anytime	sunburn	anytime	Not serious
6. Removable, small, colored spots on leaves or bark	anytime	scale insects	summer	Spray only if infestation is extensive
7. Fish-scale-like scales underleaf, translucent; small, white, flying insects	spring to fall	whiteflies	spring to fall	Leads to sooty mold; rarely requires control
8. Spirals of eggs or small black insects underleaf	anytime	blackfly	anytime	Leads to sooty mold; insecticides do not work, parasites normally in control
9. Black sooty coverings on leaves	anytime	sooty mold	anytime	Control causal insects or wash off with soapy water
10. Leaf yellowing, drop and twig dieback	anytime	root damage	anytime	Usually too much water, poor drainage
11. Leaf yellowing, tipburn marginal necrosis, drop	anytime	salt burn	anytime	Leach soil, be careful with fertilizer
12. Leaf yellowing, yellow area confined to veins	anytime	foot rot, water damage	anytime	Determine cause and correct, if possible
13. Marginal necrosis, leaf cupping, curling	spring flush	wind burn	during spring flush	Usually not serious, windbreaks may help
Limbs, trunk or entire tree				
1. Tree looks sick, sparse, yellow-veined foliage, dead bark on trunk near ground	anytime	foot rot	anytime	Remove dead tissues, disinfect and treat with pruning paint; follow recommended cultural practices
2. Hardened gum exudate on bark of trunk or limbs	anytime	gummosis	anytime	Follow good cultural practices, no control, not usually life-threatening
3. Young tree seemingly loses all its leaves quickly, fruit hangs on	anytime	foot rot	anytime	Check for foot rot (dead bark) completely around trunk at and above the bud union

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